SOME SOLUTIONS WITH TORSION IN CHERN-SIMONS GRAVITY AND OBSERVABLE EFFECTS

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Abstract.   It is shown that in five dimensional Einstein-Gauss-Bonnet theories exact vacuum solutions with non-vanishing torsion can be constructed.

Some possible observational effects related to neutrino oscillations are pointed out.

In the theory of continuum media (in which suitable defects can be described by localized non vanishing torsion) "the gravitational intuition" is a rather useful tool to describe the physical effects of such defects. A possible astrophysical application is shortly described.

1. Introduction

Finding the correct quantum theory of gravity is a major problem in theoretical physics. Although there are very strong proposals such as superstring theory and loop quantum gravity, the final answer has not been found yet. Thus, it is worth to explore new possibilities. Among the many proposals available in the literature, the possibility to have gravitational actions different from the Einstein-Hilbert one and with non vanishing torsion is worth to be explored. The most natural generalizations of the Einstein-Hilbert action are the so called Lovelock action [1]. Lovelock actions are the most general covariant actions leading to second order equation for the metric (it is a very difficult task to provide one with a complete list of references on the subject; a nice review on the black hole solutions is [2]). Unlike the four dimensional case in which torsion vanishes, in higher dimensional Lovelock theories torsion may represent propagating degrees of freedom [3], [4]. However, up to now the possible dynamical role of torsion has not been taken into account too seriously.

In this paper an intriguing analogy between BPS states in QFT and gravity with torsion will be explored. This analogy allows to find interesting solutions in five dimensional Einstein-Gauss-Bonnet gravity in which the torsion looks like topological excitations and may improve the stability of torsion-free solutions. Fur-